Office of Food Safety and Shellfish Programs 2003 Annual Inventory:

Commercial & Recreational Shellfish Areas of Washington State

June 2004



Office of Food Safety and Shellfish Programs **2003 Annual Inventory**:

Commercial & Recreational Shellfish Areas of Washington State

June 2004



The Department of Health works to improve and protect the health of people in Washington State

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INTRODUCTION

This is the fifteenth edition of the *Annual Inventory of Commercial and Recreational Shellfish Areas of Washington State.* Formerly titled the *Annual Inventory of Commercial and Recreational Shellfish Areas of Puget Sound,* the name was recently amended to more accurately reflect the scope of this document, which includes Washington's coastal waters as well as those of the Puget Sound.

This publication is produced by the Washington State Department of Health, Office of Food Safety and Shellfish Programs (DOH). It provides important health information about shellfish resources in Washington's marine waters and contributes to the fulfillment of the Puget Sound Water Quality Management Plan.

The Puget Sound Water Quality Management Plan, administered by the Puget Sound Water Quality Action Team, is the state's strategy for protecting Puget Sound's health — its water quality and its biological resources. DOH participates with many other agencies to carry out the plan.

Included with this publication is a poster-size map of the state's shellfish growing areas. The map includes features such as commercial growing area classifications, major streams, sewage treatment plant outfalls, and recreational shellfish beach classifications. Comments or suggestions are welcome for future editions. Map information is available in electronic GIS format.

Please contact Jan Jacobs at (360) 236-3316 with any comments or requests for this publication. An electronic copy of this publication can be found on the Internet at www.doh.wa.gov/ehp/sf/pubs.



DEFINITIONS AND PROCESS FOR CLASSIFYING COMMERCIAL SHELLFISH GROWING AREAS

DOH classifies all commercial shellfish growing areas in Washington State as Approved, Conditionally Approved, Restricted, or Prohibited. These classifications have specific standards associated with them, which are derived from the *National Shellfish Sanitation Program Model Ordinance* (Chapter IV, 1999 Revision).

Definitions

Approved Areas

This classification authorizes the growing and harvesting of shellfish for direct marketing. DOH may classify a growing area as Approved when pollution source evaluations and the bacteriological water quality data show that fecal material, pathogenic microorganisms, and poisonous or deleterious substances are not present in dangerous concentrations.

The bacteriological quality of marine water samples collected from an Approved growing area must satisfy both parts of the following standard:

- The concentration of fecal coliform bacteria, the indicator organisms, shall not exceed a geometric mean of 14 per 100 milliliters (ml); and
- 2) The estimated 90th percentile cannot exceed 43 organisms per 100 ml if sampling under the systematic random

scheme. If sampling where point sources of pollution may impact the growing area, not more than 10 percent of the samples can exceed 43 organisms per 100 ml.

A minimum of 30 samples is used for these calculations with the Public Health Laboratory using the A-1 modified, 5-tube/3-dilution method to estimate the most probable number of fecal coliform bacteria.

Even if the Approved criteria are met for fecal coliform bacteria, DOH may classify a growing area as Conditionally Approved, Restricted, or Prohibited (see definitions below) if pollution source investigations show that contamination may impact the sanitary condition of shellfish in the area. Because fecal coliform bacteria are not always good indicators of the presence of disease-causing viruses and other pathogens, DOH depends on thorough evaluations of pollution sources. DOH temporarily closes Approved shellfish growing areas when events such as floods or biotoxin blooms occur.

Conditionally Approved

A growing area that meets Approved criteria only during predictable periods may be classified as Conditionally Approved. For example, in some growing areas DOH has been able to show that Approved criteria are met except for several days following a particular amount of rainfall. DOH manages the area by closing it for a specified time period following that quantity of rainfall.



Restricted

If the bacteriological water quality of a commercial growing area does not meet the standard for an Approved classification, but the sanitary survey indicates only a limited degree of pollution, the area may be classified as Restricted. Shellfish harvested from Restricted growing areas cannot be marketed directly, but must be "relayed" to an Approved growing area where they will naturally purge themselves of contaminants. The cleansing period required is generally a few weeks to several months. Restricted classifications are considered only where levels of pollution are low and relay times are shown to purify the shellfish prior to marketing.

Prohibited

A growing area must be classified as Prohibited when information indicates that fecal material, pathogenic microorganisms, or poisonous or deleterious substances may be present in dangerous concentrations. Marine waters adjacent to sewage treatment plant outfalls, marinas, and other persistent or unpredictable pollution sources must be classified as Prohibited. *Commercial harvests of shellfish are not allowed from Prohibited areas.*

Under the National Shellfish Sanitation Program, if DOH has not conducted a sanitary survey, it must classify the growing areas as Prohibited.

Process

The commercial growing area classification process is called a "sanitary survey" and consists of three parts. These are:

- The "shoreline survey," an investigation of point and nonpoint pollution sources that may impact shellfish sanitation;
- 2) The "marine water quality evaluation," an analysis of the bacterial water quality in the marine water; and
- 3) The "meteorological and hydrographic evaluation," an analysis of meteorological and hydrographic factors that may affect the distribution of pollutants in the area.

The purpose of the pollution source surveys and water quality studies are to ensure that the area complies with the standards associated with its classification, to modify the classification when needed, and to notify the responsible agencies about identified contamination sources. Monitoring data and reports resulting from these studies are transmitted to local governments and the Department of Ecology. These reports are available to interested parties upon request. For more information on the classification process, contact Bob Woolrich at (360) 236-3329.

In addition to water quality monitoring and shoreline surveys, paralytic shellfish poisoning and domoic acid samples are collected in classified areas on a routine basis. (See Marine Biotoxin Monitoring Program, page 24.)



Shoreline Survey

The shoreline survey component of the sanitary survey consists of the periodic evaluation of all point and nonpoint contamination sources located where they have the potential to impact a growing area. Sources are identified and evaluated through field surveys conducted by DOH in cooperation with local health departments, Tribes, and the Department of Ecology. Emphasis is placed on general shoreline activity, on-site sewage systems, animal farms, drainage ways, and wildlife activity. Pollution sources needing corrections are referred to the appropriate pollution control agencies for action. DOH also evaluates the

actual and potential impacts of point sources, and establishes closure zones around wastewater treatment plants and marinas.

During 2003, DOH completed shoreline surveys within 10 classified commercial growing areas and 6 new areas that had been requested for harvest. The completed surveys encompassed 111 marine shoreline miles, 599 shoreline parcels, and 380 drainage/discharge points. Figure 1 lists the areas, shoreline miles, parcels, and drainage/discharge points evaluated. For more information regarding shoreline surveys, or to request a copy of a shoreline survey report, contact Scott Berbells at (360) 236-3324.

Figure 1. Shoreline Surveys Completed in 2003

Area	Marine Shoreline Miles	Parcels Evaluated	Drainages / Discharges Evaluated
Discovery Bay	23	172	109
Hood Canal 4 (addendum)	2	6	7
Mackaye Harbor	3	3	2
Nahcotta (addendum)	9	5	0
Nemah River	9	4	5
Oakland Bay	12	119	70
Point Partridge	8	55	7
Port Madison (addendum)	2	26	13
Port Orchard (addendum)	1	0	18
Quartermaster Harbor	6	59	74
Saltwater State Park	2	0	12
Samish Bay	14	65	17
Shoal Bay	2	34	0
Skookum Inlet	10	45	41
Stoney Point	6	6	2
Whiteman Cove (addendum)	2	0	3



Marine Water Quality

Marine water samples are collected to measure the concentration of fecal coliform bacteria in the growing waters. The concentration of fecal coliform bacteria can indicate the presence of pathogens that transmit hepatitis, salmonella, and other diseases to humans. DOH conducts water quality sampling throughout the year in all active commercial shellfish growing areas.

In 2003, DOH collected over 10,000 marine water quality samples from approximately 1,400 sampling stations. For more information regarding marine water quality sampling and station locations contact Jerry Lukes at (360) 236-3319.

Meteorological and Hydrographic Factors

Meteorological and hydrographic information is used by DOH to determine the extent and impact from a known pollution source on a shellfish growing area. This information is obtained from other agencies as well as from studies done by DOH, and is described in more detail in the Closure Zone Determination section on page 17. For more information regarding meteorological and hydrographic factors contact Frank Meriwether at (360) 236-3321.

STATUS OF COMMERCIAL SHELLFISH GROWING AREAS

In 2003, DOH classified 93 commercial harvest areas in the state covering over 200,000 acres. Many of the classified harvest areas had multiple classifications. For example, in the area called Henderson Inlet DOH classified portions as Approved, Conditionally Approved, and Prohibited.

In 2003, we had 87 areas with Approved classifications, 14 areas with Conditionally Approved classifications, and 7 growing areas with Restricted classifications.

DOH managed the 14 Conditionally Approved areas under a variety of predictable pollution circumstances as shown in Figure 2.

In 2003, DOH reclassified three growing areas. Dungeness Bay was downgraded and North Dyes Inlet and Portage Bay were upgraded. Figure 3 shows the reclassifications of intertidal shellfish growing areas done in 2003.

Since 1981, DOH has downgraded the classification of about 48,000 acres as the result of declines in sanitary conditions, but has upgraded only about 20,000 acres. In the 1980s, DOH downgraded the classification of almost 33,000 acres, but upgraded only about 1,000 acres. However, since 1990, about 15,000 acres have been downgraded and 19,000 have been upgraded. These classification changes are shown in Figure 4.



Figure 2. Conditionally Approved Areas in 2003

Area	Closure Criteria	Minimum Closure Length
Filucy Bay	≥0.5" rainfall / 24 hr.	6 days
Henderson Inlet	≥0.5" rainfall / 24 hr.	5 days
Oakland Bay	≥1.0" rainfall / 24 hr. or upset at wastewater treatment plant	5 days
Dungeness Bay	Seasonal Closure	Nov 1 - Jan 31
Grays Harbor	Upset at wastewater treatment plant	7 days
Penn Cove	Upset at wastewater treatment plant	5 days
South Skagit Bay	Upset at wastewater treatment plant	5 days
North Dyes Inlet	Combined sewer overflows	7 days
Barlow Bay	Seasonal marina	May 1 - Sept 30
Blake Island	Seasonal marina	May 1- Sept 30
Mystery Bay	Seasonal marina	May 1- Sept 30
Quilcene Boat Basin	Seasonal marina	May 1- Sept 30
Sequim Bay State Park	Seasonal marina and sewage land applications	Sept 1-15 and 7 days after applications
Twanoh State Park	Seasonal marina	May 1- Sept 30

Figure 3. 2003 Reclassifications of Intertidal Shellfish Growing Areas

Growing Area	County	Classification	Acreage
Dungeness Bay	Clallam	Approved to Prohibited Approved to Conditionally Approved	227 1062
Dyes Inlet	Kitsap	Prohibited to Conditionally Approved Prohibited to Restricted	1498 16
Portage Bay	Whatcom	Restricted to Approved	625



Figure 4. Commercial Shellfish Growing Area Reclassifications Since 1981

Crowing		Classificatio	n Down	grades		Classificati	on Upgı	rades
Growing Area	Year	Change	Acres	Reason	Year	Change	Acres	Reason
Bay Center (Pacific Co.)	11/89	Approved to Prohibited	1,590	Rural nonpoint	9/92	Prohibited to Conditionally Approved	1,030	Improvement in shoreline conditions
					10/99	Conditionally Approved to Approved	340	Improved water quality results
					6/00	Conditionally Approved to Approved	690	Improved water quality results
Burley Lagoon (Pierce Co.)	1981	Approved to Restricted	210	Rural nonpoint	10/93	Restricted to Conditionally Approved	210	Correction of sewage system failures and agricultural waste problems
	1/99	Conditionally Approved to Restricted	210	Rural nonpoint	1/99	Prohibited to Restricted	20	Administrative change only
					5/01	Restricted to Approved	110	Correction of sewage system failures and agricultural waste problems
Chico Bay / Dyes Inlet (Kitsap Co.)					12/93	Prohibited to Restricted	150	Reevaluation of point sources
Dosewallips (Jeff. Co.)	9/87	Approved to Restricted	180	Marine mammals (seals)	4/94	Restricted to Approved	30	Seals access to shoreline area was restricted
Drayton Harbor (What. Co.)	1988	Approved to Prohibited	620	Rural nonpoint				
	1/95	Approved to Restricted	30	Point source and rural nonpoint				
	1/95	Approved to Prohibited	1,010	Point source and rural nonpoint				
	9/99	Approved to Prohibited	920	Various point and nonpoint pollution sources				



Figure 4 continued. Commercial Shellfish Growing Area Reclassifications Since 1981

Crowing		Classificatio	n Down	grades	Classification Upgrades			
Growing Area	Year	Change	Acres	Reason	Year	Change	Acres	Reason
Duckabush (Jefferson Co.)	7/88	Approved to Restricted	630	Rural nonpoint	3/01	Restricted to Approved	630	Improved water quality
Dungeness Bay (Clallam County)	1/00	Approved to Prohibited	300	Area near mouth of river closed due to rural nonpoint pollution				
	4/01	Approved to Prohibited	100	Rural nonpoint pollution				
	9/03	Approved to Prohibited	227	Rural nonpoint				
	9/03	Approved to Conditionally Approved	1062	Rural nonpoint				
Dyes Inlet					12/03	Prohibited to Conditionally Approved	1498	Reduction in combined sewage overflows
					12/03	Prohibited to Restricted	16	Administrative change only
Eld Inlet (Thurs. Co.)	2/83	Approved to Conditionally Approved	690	Rural nonpoint	2/98	Conditionally Approved to Approved	450	Repair of on- site sewage systems and improved farm practices
Filucy Bay (Pierce Co.)	8/01	Conditionally Approved to Restricted	7	Rural nonpoint pollution				
Grays Harbor (Grays Harbor Co.)					11/94	Conditionally Approved to Approved	17,370	Not the result of changes in sanitary conditions, but rather a reevaluation of hydrography
					8/02	Conditionally Approved to Approved	479	Improved water quality results



Figure 4 continued. Commercial Shellfish Growing Area Reclassifications Since 1981

Crowing		Classificatio	n Down	grades		Classificati	on Upgı	rades
Growing Area	Year	Change	Acres	Reason	Year	Change	Acres	Reason
Hammersley Inlet (Mason Co.)					6/92	Prohibited to Approved	200	Not the result of changes in sanitary conditions, but rather a reevaluation of sewage treatment plant discharge and water quality
Henderson Inlet (Thurston Co.)	1984	Approved to Conditionally Approved	180	Nonpoint				
	1985	Conditionally Approved to Prohibited	120	Nonpoint				
	9/00	Conditionally Approved to Prohibited	8	Nonpoint				
	6/01	Approved to Conditionally Approved	300	Nonpoint				
Liberty Bay (Kitsap Co.)	5/91	Conditionally Approved to Restricted	260	Rural and urban nonpoint	4/94	Restricted to Approved (Lemolo Area)	70	Correction of on-site sewage system failures and re- evaluation of hydrographics
Lilliwaup Bay (Mason Co.)	7/98	Approved to Prohibited	22	Area failed fecal coliform standard; wildlife most likely cause				
Lower Hood Canal (#9) (Mason Co.)	1987	Approved to Prohibited	630	Rural nonpoint	10/96	Restricted to Approved	530	Correction of on-site sewage system failures
	2/93	Approved to Prohibited	960	Rural nonpoint including on- site sewage system failures	5/98	Prohibited to Approved	400	Repairs of on- site sewage systems
Minter Bay (Pierce Co.)	1982	Approved to Prohibited	60	Rural nonpoint				



Figure 4 continued. Commercial Shellfish Growing Area Reclassifications Since 1981

Crowing		Classificatio	n Down	grades	Classification Upgrades			
Growing Area	Year	Change	Acres	Reason	Year	Change	Acres	Reason
Nisqually Reach (Thurston Co.)	6/92	Approved to Conditionally Approved	2,130	Rural nonpoint				
	9/00	Conditionally Approved to Restricted	74	Rural nonpoint	9/00	Conditionally Approved to Approved	20	Improved water quality results
					7/02	Conditionally Approved to Approved	960	Improvements in nonpoint pollution sources
North Bay (Mason Co.)	5/91	Approved to Prohibited	1,260	On-site sewage system failures	10/91	Prohibited to Conditionally Approved	450	Correction of on-site sewage system failures
					6/92	Prohibited to Conditionally Approved	710	Correction of on-site sewage system failures
					10/92	Prohibited to Restricted	100	Correction of on-site sewage system failures
					9/02	Conditionally Approved to Approved	1,110	Community sewer system developed
North River (Pacific Co.)					7/98	Prohibited to Approved	900	On-site systems discharging to Willapa River connected to sewer
Oakland Bay (Mason Co.)	2/87	Conditionally Approved to Restricted	1,380	Urban point and nonpoint	4/89	Restricted to Conditionally Approved	1,380	Improvement in water quality
Penn Cove (Island Co.)	1983	Conditionally Approved to Prohibited	500	Sewage treatment plant	1/95	Prohibited to Conditionally Approved	450	Sewage treatment plant and nonpoint source improvements
Port Gamble Bay (Kitsap Co.)	7/96	Approved to Prohibited	20	Rural nonpoint	3/99	Prohibited to Approved	20	Rural nonpoint sources corrected
Port Susan (Snohomish & Island Co.)	5/87	Approved to Restricted	11,9- 00	Agricultural nonpoint/ sewage treatment plant				



Figure 4 continued. Commercial Shellfish Growing Area Reclassifications Since 1981

Crowing		Classificatio	n Down	grades		Classificati	on Upgı	rades
Growing Area	Year	Change	Acres	Reason	Year	Change	Acres	Reason
Portage Bay (Whatcom Co.)	8/97	Approved to Restricted	60	Rural nonpoint				
	9/99	Approved to Restricted	90	Rural nonpoint	12/03	Restricted to Approved	625	Dairy waste management improvements
Quilcene Bay (Jefferson Co.)	1984	Approved to Prohibited	200	Rural nonpoint				
Rocky Bay (Mason Co.)	8/95	Approved to Prohibited	30	Rural nonpoint	12/01	Prohibited to Approved	15	Rural nonpoint pollution corrected
Samish Bay (Skagit Co.)	8/94	Approved to Restricted	490	Agricultural, rural nonpoint including on- site sewage system failures				
	8/94	Approved to Prohibited	2,200	Agricultural, rural nonpoint including on- site sewage system failures	5/98	Restricted to Approved and Prohibited to Conditionally Approved	835	Repair of sewage problems in near shore communities
					7/02	Conditionally Approved to Approved	350	Improvements in nonpoint pollution sources
Sequim Bay (Clallam Co.)	2/92	Approved to Prohibited	200	Sewage treatment plant				
	2/92	Approved to Conditionally Approved	2,830	Sewage treatment plant	6/98	Conditionally Approved to Approved	2,800	Sewage treatment plant upgrade and relocation of outfall
					1/00	Prohibited to Approved	750	Sewage treatment plant upgrade and relocation of outfall



Crowing		Classificatio	n Down	grades	Classification Upgrades			
Growing Area	Year	Change	Acres	Reason	Year	Change	Acres	Reason
Similk Bay (Skagit Co.)	7/00	Approved to Prohibited	60	Failing on-site sewage systems				
South Skagit Bay (Skagit Co.)	3/87	Approved to Restricted	6,140	Rural, agricultural nonpoint	9/93	Restricted to Conditionally Approved	2,280	Sewage treatment plant performance and correction of agricultural waste problems
Squaxin Island (Mason Co.)					7/93	Prohibited & Conditionally Approved to Approved	50	Removal of boat dock and mooring buoys

Figure 4 continued. Commercial Shellfish Growing Area Reclassifications Since 1981

Threatened Shellfish Growing Areas

Each year DOH reviews the classification and develops an annual report for each of our shellfish growing areas. During this process, DOH identifies shellfish growing areas that marginally meet their classification. Those areas are considered to be "threatened with downgrades" and are put on an "early warning list." DOH then notifies stakeholders and issues a press release about the threatened areas.

The list and the reports are sent to the Pacific Coast Shellfish

Growers Association, the
Northwest Indian
Fisheries Commission, the
Puget Sound Action
Team, and the

Department of Ecology. In addition, DOH sends reports to the local health departments and shellfish growers who harvest in threatened areas. The objective is to correct pollution problems in order to prevent the closure or downgrade of a growing area.

Downgrades in classification are bad news. They restrict or eliminate commercial harvesting of shellfish; they close public shellfish beaches to recreational shellfish harvesters; and they indicate that pollution is getting worse. Downgrades also require a reaction. When an area is downgraded due to nonpoint pollution, state law requires local governments to form shellfish protection districts to address the problem.

According to our analysis in March of 2003, all commercial shellfish growing areas met their current classifications. However, DOH



identified 22 areas as "threatened" (see Figure 5). They are:

- Annas Bay (Mason County)
- Birch Bay (Whatcom County)
- Burley Lagoon (Pierce County)
- Discovery Bay (Jefferson County)
- Dungeness Bay (Clallam County)
- Eld Inlet (Thurston County)
- Filucy Bay (Pierce County)
- Fox Island (Pierce County)
- Grays Harbor (Grays Harbor County)
- Henderson Inlet (Thurston County)
- Lynch Cove (Mason County)
- MacKaye Harbor (San Juan County)
- Nahcotta (Pacific County)
- Naselle River (Pacific County)
- North Bay (Mason County)
- Pacific Coast (Grays Harbor County)
- Port Gamble / Cedar Cove (Kitsap County)
- Port Madison (Kitsap County)
- Portage Bay (Whatcom County)
- Rocky Bay (Pierce County)
- Samish Bay (Skagit County)
- South Skagit Bay (Snohomish County)

For more information on threatened shellfish growing areas, contact Bob Woolrich at (360) 236-3329.

Fecal Coliform Status and Trends in Commercial Shellfish Beds

DOH participates with other agencies in the Puget Sound Ambient Monitoring Program (PSAMP) to assess the health of Puget Sound. DOH addresses two questions for PSAMP:

- What is the status of fecal pollution in shellfish beds?
- Has fecal pollution changed over time?

To answer these questions, fecal coliform statistics used by DOH to classify growing areas (geometric means and ninetieth percentiles) are adapted to meet PSAMP objectives. For PSAMP, statistics are calculated for each sampling date starting from the earliest date having the minimum required number of prior results (30) forward to the most recent date available. The PSAMP procedure is nearly identical to the initial steps for classifying growing areas. However, classification requires additional data analysis.

DOH recently evaluated pollution status of over 1200 sampling stations in 95 commercial shellfish growing areas in Puget Sound for the year ending in December 2003. Detailed analysis for trends is underway but is not yet completed.

Status of fecal coliform pollution in shellfish growing areas

To determine pollution status, ninetieth percentiles were calculated from fecal coliform data for each station for all sampling dates in 2003. The ninetieth percentiles were sorted into three categories: **GOOD** (0-30 MPN per 100 ml), **FAIR** (31-43 MPN per

100 ml) or **BAD** (above 43 MPN per 100 ml). The ninetieth percentiles in each category were summed among all the stations in each growing



continued on page 16



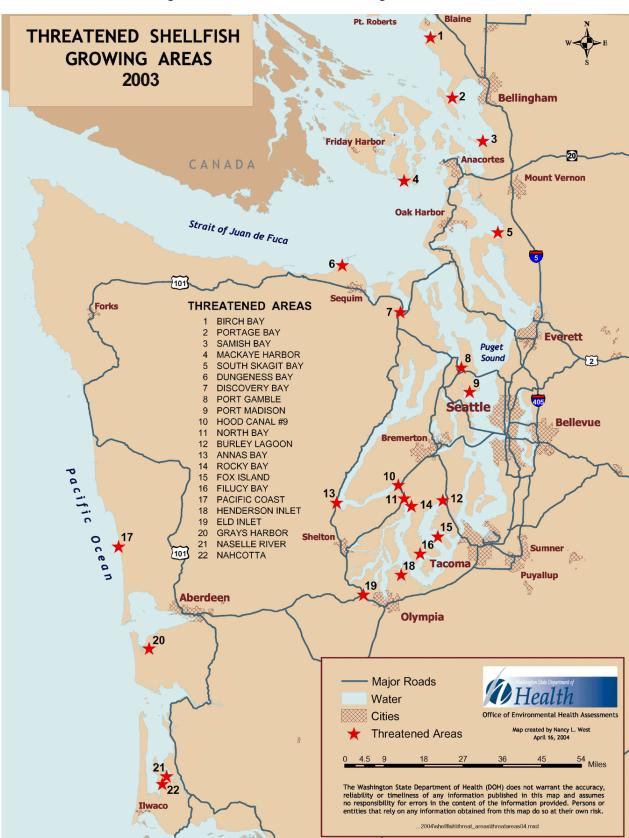


Figure 5. Threatened Shellfish Growing Areas in 2003



Growing areas listed in BOLD had stations with statistics that were FAIR or worse. **STATUS** GOOD FAIR NORTH PUGET SOUND AND GEORGIA STRAIT BELLINGHAM 1. Drayton Harbor 2. Birch Bay 3. Alden Banks GOOD: Statistic <=30 MPN/100ml; 4. Lummi Island 5. Lummi Bay FAIR: Statistic >30 MPN/100ml, 6. Portage Bay7. East San Juan Islands but <=43 MPN/100ml; 8. Samish Bay BAD: Statistic > 43 MPN/100ml. 9. Padilla Bay 10. Similk Bay 11. North Whidbey Island Notes: 12. Swinomish Status applies from January through 13. South Skagit Bay December 2003. 14. Penn Cove Status was determined as a percent of 15. Saratoga Passage ninetieth percentiles falling into each 16. Holmes Harbor category (GOOD, FAIR, or BAD). 17. Possession Sound 18. Port Susan ADMIRALTY INLET AND MAIN BASIN PUGET 14 SOUND 19. Mats Mats Bay 20. Oak Bay 80 21. SW Whidbey Island SEQUIM 22. Kingston PORT ANGELES 23. Port Madison 24. Agate Passage 25. Lemolo (Liberty Bay) SAN JUAN ISLANDS 16 64. Westcott Bay 26. Dyes Inlet 27. Port Orchard (Passage) 65. Blind Bay 66. Buck Bay 28. Port Blakely 67. East Sound 29. Blake Island 68. Upright Channel 30. Saltwater State Park 69. Shoal Bay 31. East Passage 70. Lopez Island 83 32. Colvos Passage 71. Hunter Bay 33. Quartermaster Harbor 72. Mud Bay 22 SOUTH PUGET SOUND 73. MacKay e Harbor 34. Tacoma Narrows 25 STRAIT OF JUAN DE FUCA 35. Fox Island 74. Pt. Partridge 36. Burley Lagoon 75. Kilisut Harbor/Mystery Bay 37. Henderson Bay SEATTLE 38. Penrose Point SP 76. Port Townsend 39. Wyckoff Shoals 77. Discovery Bay 89 26 40. Balch Passage 78. Protection Island 28 41. Filucy Bay 79. Sequim Bay 80. Jamestown 42. Drayton Passage 43. Thompson Cove (Ander. Is.) 81. Dungeness Bay 44. Oro Bay (Anderson Island) 82. East Strait 45. Nisqually Reach HOOD CANAL AND APPROACHES 46. McMicken Island 31 83. Hood Canal #1 47. Whiteman Cove 84. Port Gamble 93 48. Budd Inlet 49. Henderson Inlet 85. Hood Canal #2 50. Eld Inlet 86. Quilcene Bay 87. Dabob Bay 51. Skookum Inlet 52. Totten Inlet 88. Hood Canal #3 (incl. Dosewallips) 53. Oakland Bay 89. Hood Canal #4 54. Hammersley Inlet 90. Hood Canal #5 (incl. Lilliwaup) TACOMA 55. Peale Passage 91. Hood Canal #6 SHELTON 92. Annas Bay 56. Pickering Passage 93. Hood Canal #7 57. Spencer Cove 58. Dutcher Cove 94. Hood Canal #8 59. Stretch Island 95. Hood Canal #9 (Lynch Cove) 60. Vaughn Bay 61. Reach Island 62. Rocky Bay

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Figure 6. Fecal Coliform Pollution in Shellfish Growing Areas in 2003



63. North Bay

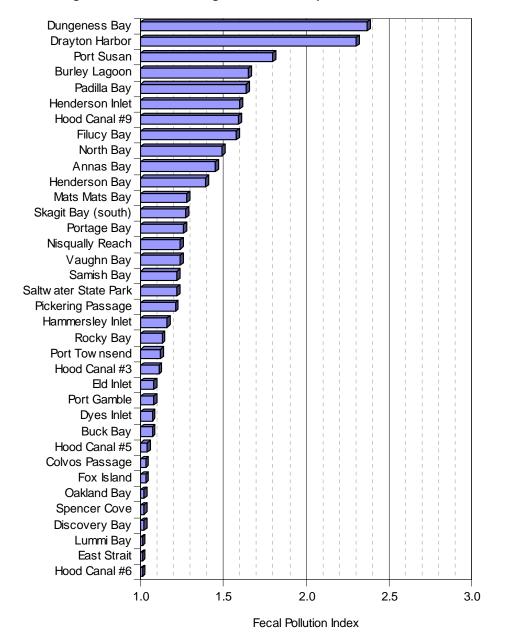


Figure 7. Shellfish Growing Areas Ranked by Fecal Pollution Index

continued from page 13

area. A pie chart of the fractions for each growing area can be visually compared with those for other growing areas in Puget Sound and the Straits of Georgia and Juan de Fuca (Figure 6). Drayton Harbor (near the

international border), and Dungeness Bay (near Sequim on the Strait of Juan de Fuca) appeared to be the most affected by fecal pollution in 2003.



Ranking growing areas and regions with the "Fecal Pollution Index"

A "Fecal Pollution Index" or FPI was calculated for each growing area, as follows: First, the fraction of stations within each category was multiplied by a corresponding weighting factor (GOOD: 1.0; FAIR: 2.0; or BAD: 3.0). Next, the resulting weighted fractional values are added to produce the FPI. In simple terms, if 100% of the stations in the growing area are GOOD, the index is 1.0 (1.00 x 1.0). An index of 3.0 means 100% of the stations are BAD (1.00 \times 3.0). A growing area with a mixture of categories falls between the 1.0 and 3.0. Figure 7 arrays the indices of 36 growing areas (over a third of the shellfish areas evaluated) impacted by fecal pollution (i.e., FPI>than 1.0) in 2003. The bar graphs in Figure 7 agree with our visual impressions from Figure 6. Dungeness Bay was the most affected in 2003 (FPI = 2.37), followed by Drayton Harbor (FPI = 2.30).

The concept of calculating FPI was extended to the level of the region. For each region the total of stations within each category (GOOD, FAIR, BAD) was calculated. Next the weighted proportion of stations in each category was determined as described above. The weighted proportions were summed to produce an FPI for each of the regions: South Puget Sound had the highest pollution impact (FPI = 1.24), followed closely by the Strait of Juan de Fuca (FPI = 1.23). Next came North Puget Sound/Georgia Strait (FPI = 1.16), Hood Canal (1.09), Admiralty Inlet and the Main Basin (1.03), and the San Juan Islands (1.00).

Comparing 2002 and 2003 using the FPI.

Forty shellfish growing areas showed significant fecal pollution impact (FPI>1.00) in either 2002 or 2003. The FPIs for 15 areas decreased between 2002 and 2003, suggesting that fecal pollution may have declined in these areas. In fact, 4 of the 15 areas moved into the GOOD category (FPI=1.00). The greatest reductions occurred in Henderson Inlet (FPI reduced from 1.97 to 1.60), Drayton Harbor (FPI dropped from 2.57 to 2.30), and Portage Bay (from 1.63 to 1.26). On the other hand, fecal pollution may have increased in 22 areas, including Port Susan (FPI increased from 1.0 to 1.8), Padilla Bay (1.0 to 1.64), and Burley Lagoon (1.36 to 1.65). In general, the significance of short-term changes in FPI is as yet unknown. More analysis will be required.

Closure Zone Determinations

Shellfish are filter feeders and they can accumulate and concentrate nearby disease-causing organisms. Therefore it is important that the public be protected from consuming shellfish located near actual and potential sources of pollution. Closure zones are established by DOH around sources of pollution to prevent harvest and consumption of contaminated shellfish. Typical sources are sewage treatment plants, marinas, and nonpoint sources such as river discharges or runoff from watersheds following heavy rainfall. For example, there are more than 60 sewage treatment plant outfalls



discharging to the marine waters of the state, some near shellfish growing areas. The daily discharge from these treatment plants varies greatly, from tens of thousands of gallons at small plants to over one hundred million gallons at the larger facilities.

DOH conducts a technical evaluation for each sewage treatment plant and marina located near an area of commercial or recreational shellfish harvest. Evaluations for each potential pollution source include inspection of the facility by a DOH engineer, gathering information on water currents and characteristics near the site, and evaluating the dilution and dispersion of any wastewater discharged from the facilities. Frequently DOH conducts its own studies to better understand the movements of marine waters in the area if such information is not available, or works with the consultants of these facilities to generate the information. DOH studies can include the measurement of dye injected into a treatment plant's discharge by boat-mounted equipment, and the use of fixdepth floats to study the dilution, current speed, and direction in the nearby marine waters. DOH uses the information, collected at marinas and sewage treatment plants, in computer models to calculate the size of closure zone for each facility, using the protective assumption that an unplanned

has occurred. In addition, each sewage treatment plant is required to call

DOH immediately if a bypass occurs, or if a problem occurs with the disinfection system. In turn, DOH may close the area near a pollution discharge to commercial and public recreational shellfish harvesting, and contacts stakeholders such as county health departments, tribal and non-tribal shellfish harvesters, and the Washington State Department of Fish and Wildlife. Using this approach, the public is protected from consuming contaminated shellfish near potential pollution sources, even during unusual conditions. For more information contact Frank Meriwether at (360) 236-3321.

SHELLFISH GROWING AREA RESTORATION PROGRAM

The goal of the DOH Restoration Program is to reopen commercial and recreational shellfish beds that have been closed or have harvest restrictions and to prevent the closure of shellfish areas that are still open but threatened. The Restoration Program works cooperatively with entities such as local governments, the Puget Sound Water Quality Action Team, Tribes, and the Department of Ecology. Program activities include notifying affected parties about classifications that are threatened, water quality testing, participating in surveys to identify pollution sources, serving as a member or advisor on watershed committees, and assisting in the development of watershed management plans and closure response plans.



Restoration Projects

DOH Restoration Program projects in 2003 included:

Dungeness Bay (Clallam County) Efforts to identify pollution sources that continue to impact Dungeness Bay are ongoing. In September 2003, 1062 acres within the inner portion of Dungeness Bay were reclassified as Seasonally Conditionally Approved and 227 acres in the outer bay were downgraded to Prohibited. The inner bay is now closed to shellfish harvest during the months of November, December, and January.

Lower Hood Canal (Mason County) DOH is continuing to work with Mason County to identify and correct pollution sources in the Lynch Cove area. The Belfair State Park completed construction of a new on-site sewage system, and a recreational vehicle park located on the shoreline adjacent to the State park dramatically reduced the number of hookups to its on-site system. Water quality in the area has improved.

Approximately 138 acres of the Prohibited area lying to the west of the Belfair State Park is being upgraded to Approved.

Burley Lagoon (Pierce and Kitsap Counties)
DOH is continuing to work with Kitsap and
Pierce Counties to identify pollution sources
that continue to impact Burley Lagoon.

<u>Dyes Inlet (Kitsap County)</u> DOH upgraded approximately 1500 acres in northern Dyes Inlet from Prohibited to Conditionally Approved in December 2003. The upgrade was due to

improvements in Bremerton's stormwater and sewer collection systems and a hydrographic study that provided detailed information about water movement within Dyes Inlet and the Port Washington Narrows.

North Bay (Mason County) DOH is continuing to work with Mason County to identify the pollution sources that are impacting water quality along the shoreline at Allyn and in the vicinity of the Port of Allyn dock. Shellfish beds immediately to the north of the Port of Allyn dock remain closed pending the outcome of these investigations.

Filucy Bay (Pierce County) Water quality problems continue to exist in the northern portion of Filucy Bay. Ongoing restoration work in the watershed includes testing of onsite sewage systems and investigations of animal keeping practices. DOH conducts monthly marine water and stream sampling in cooperation with the Tacoma-Pierce County Health Department.

Drayton Harbor (Whatcom County) DOH is continuing to work with the Citizens Watershed Committee, the City of Blaine Public Works Department, various Whatcom County agencies, and the Northwest Indian College to identify and correct the sources of pollution that continue to impact Drayton Harbor. High levels of bacterial pollution were observed near the mouth of the harbor. DOH personnel conducted a drogue and dye study in July 2003 to determine what influence the pollution might be having on the inner portions of the bay. The study indicated that a significant



amount of dilution occurs between the contaminated region near the mouth of the bay and the inner portions of the harbor. Drayton harbor is currently being evaluated for a possible upgrade in classification.

Portage Bay (Whatcom County) DOH is continuing to work with Lummi Natural Resources, Northwest Indian College, Department of Ecology, and Whatcom County Water Resources on the restoration of the Portage Bay shellfish area. Since restoration efforts were started, several farm plans have been implemented and the area has seen a decrease in the number of dairy farming operations. Improvements in water quality enabled DOH to upgrade 625 acres from Restricted to Approved in October 2003.

<u>Samish Bay (Skagit County)</u> DOH continues to work with the Skagit County Health and Public Works and area shellfish growers to locate and correct pollution sources in the Samish Bay watershed.

Oro Bay (Pierce County) DOH reopened Oro Bay to commercial shellfish harvest in 2003. Oro Bay was placed in closed status in 2001 pending the outcome of pollution source investigations by Pierce County. The shoreline survey was completed in 2003. Two failing on-site systems were identified

and repaired and the area now meets the water quality standard for an Approved classification.

PUGET SOUND AMBIENT MONITORING PROGRAM

The Department of Health Office of Food Safety and Shellfish Programs participates in the Puget Sound Ambient Monitoring Program (PSAMP). The goals of PSAMP are to:

- Assess the health of Puget Sound and its resources;
- Identify existing environmental problems;
- Provide data to help the Puget Sound
 Water Quality Action Team and others to
 measure the outcome of environmental
 programs;
- Provide a permanent temporal record of significant natural and human-caused changes in key environmental indicators in Puget Sound; and
- Support research activities by making available scientifically valid data.

The primary goal of DOH is to assure the health and safety of shellfish consumers. Information gathered by DOH programs can also be used to meet the broader goals of PSAMP.

Data are drawn from two office programs: the Biotoxin Monitoring Program and the Commercial Areas Water Quality Monitoring Program.

During the past year, the PSAMP analysis has been publicly presented through DOH technical reports, the 2003 Puget Sound Georgia Basin Research Conference (held in Vancouver, B.C.), and posters and demonstrations at the 2003 Oysterfest in Mason County.



LICENSING AND CERTIFICATION PROGRAM

DOH's Shellfish Licensing and Certification
Program is a statewide program designed to
protect public health by licensing all
commercial shellfish companies, and to
regulate the harvesting and sanitation of
shellfish for human consumption. The
program ensures that standards are met in
the harvesting, handling, processing,
packaging, labeling, buying, storage, and
distribution of shellfish. Through formal
agreement with the Department of Fish and
Wildlife, shellfish growing areas are patrolled to
prevent the illegal harvest of shellfish from
unsafe, polluted waters.

Each company that harvests shellfish receives a Harvest Site Certificate that lists all certified sites from which the company is approved to harvest. Each approved site must undergo a pollution assessment to become certified. Specific identifiers are assigned to the site, and must be placed on harvest tags and transaction records. This identifier makes it possible to recall shellfish if a growing area or harvest site is closed due to a pollution or biotoxin event, or if shellfish are implicated in an illness.

Recent improvements to the Licensing and Certification program have allowed the expansion of information available through the world wide web. Growing area maps and a monthly listing of current Washington licensed shellfish companies are now available on the web.

Washington State Shellfish Industry

Washington State is among the top shellfish producing states in the nation, and is recognized as having one of the nation's safest supplies of shellfish. The success in assuring that Washington shellfish are among the safest in the nation is due to the cooperative efforts of DOH, the Washington Tribes, and the shellfish industry.

The commercial shellfish-licensing year runs from October 1 through September 30 each year for Shellstock Shippers and Shucker-Packers. Harvester licenses run from April 1 through March 31 each year. The Washington state shellfish industry currently consists of approximately 326 licensed, certified shellfish operations. Approximately 24 firms are licensed as shucker-packers (shellfish processing firms), and 200 as shellstock shippers. 102 firms are licensed as harvesters. DOH performed 600 routine inspections of licensed shellfish operations during the 2002 – 2003 license year.

Shucker-Packers

Shucker-packer firms either harvest or purchase shellstock, then process it in their plants by shucking, washing, and packing the meats for sale to retail markets. These processing plants are inspected for shellfish sanitation compliance a minimum of four times a year. DOH performed 94 inspections on shucker-packer firms during the October 2002-September 2003 license year.



Shellstock Shippers

Shellstock shipper firms either harvest, purchase, or reship shellstock for sale to retail markets or to other shellfish dealers. Their licenses are limited to the sale of shellstock or shucked shellfish from other licensed shucker-packer dealers only; these firms are not permitted to shuck shellfish. Shellstock shipper firms are inspected a minimum of two times per year. DOH performed 405 inspections on shellstock shipper firms during the 2002-2003 license year.

Harvesters

Harvester firms are limited to harvesting shellstock and selling it intrastate (only within the state of Washington) to licensed shucker-packer firms or shellstock shipper firms. They are not permitted to purchase shellstock, nor sell it to retail. Harvesters are not permitted to shuck shellstock, or store shellstock. Harvester operations are inspected once per license year. DOH performed 101 inspections of harvester firms during the 2002-2003 license year.

For further information contact Jessie DeLoach at (360) 236-3302.

TRIBAL SHELLFISH SANITATION PROGRAM

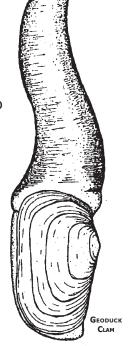
2003 began the tenth year of the Tribal Shellfish Sanitation Program since the *U.S. v. Washington* shellfish subproceeding commenced in the United States District Court of Western Washington. In 2003,

fifteen treaty tribes were certified and licensed by the Department. Those licensed as harvesters were the Lower Elwha Klallam Tribe, the Muckleshoot Tribe, the Nisqually Tribe, the Port Gamble S'Klallam Tribe, the Puyallup Tribe, the Skokomish Tribe, the Squaxin Island Tribe, and the Tulalip Tribe. Those licensed as interstate shellstock shippers were the Jamestown S'Klallam Tribe, the Lummi Indian Nation, the Suguamish Tribe, the Upper Skagit Indian Tribe, and the Swinomish Tribe. The Quinault Indian Nation and the Squaxin Island Tribe have licensed shucker-packer operations. Thirty-three individual tribal operations, owned and operated by tribal members, have received shellfish licenses.

DOH and the Tribes have continued their joint cooperation in protecting public health and participate in regular technical

meetings. Continued development of joint protocols and training, as needed, are priorities for this program.

Tribal personnel continue to assist with water quality monitoring for harvest site and geoduck tract classification requests.
Tribal representatives have provided input on proposed changes to the ISSC Model Ordinance, including a new standard in the National Shellfish Sanitation Program that





allows growing areas to be designated "inactive." Tribes have since reviewed their harvest site certificates and placed appropriate areas into inactive status, which allows temporary cessation of water sampling and surveillance efforts in those areas and permits the redirection of resources required for these activities.

Tribal geoduck harvesting operations exist in the Strait of Juan de Fuca, Hood Canal, and central and south Puget Sound. Geoduck boats and product landings are inspected for sanitation and proper handling of commercial product. Tribal monitors and patrol officers work with DOH to ensure a safe product by enforcing rules for harvesting. The Tribes also supply geoduck for biotoxin sampling, and Tribal and non-tribal harvesters share the results of analyses.

Continued cooperation between local health jurisdictions and the Tribes has been enhanced with consolidated contracts that DOH has managed. Clallam County Department of Health and Human Services and the Jamestown S'Klallam Tribe are working together to look for potential pollution sources in the Dungeness River watershed. Continued cooperation between local jurisdictions and the Tribes is ensuring shellfish growing areas remain open and approved.

In addition to establishing programs specific to commercial endeavors, cooperative efforts also benefit subsistence and recreational shellfish harvesters. The Tribes contract with DOH's biotoxin laboratory to test for paralytic shellfish poison (PSP) and domoic acid in shellfish collected on several north Pacific Coast beaches. The results are shared with all coastal shellfish harvesters.

Overall, Tribal involvement continues to result in safer shellfish and awareness of Washington shellfish sanitation issues. For more information, please contact Helen Seyferlich, Public Health Advisor at (360) 236-3323.

VIBRIO PARAHAEMOLYTICUS IN WASHINGTON STATE

DOH implements portions of the Interstate Shellfish Sanitation Conference Interim *Vibrio* parahaemolyticus Control Plan.

Routine shellfish testing is part of the control plan. Figure 8 shows the results of routine sampling of oysters from three representative commercial growing areas in Washington with significant levels of *Vibrio parahaemolyticus* (V.p.) during the summer of 2003.

Vibrio Illnesses

There were a total of seven confirmed cases of vibriosis linked to Washington molluscan shellfish during 2003. Of these:

- Three cases were linked to commercial product harvested in Washington. These cases were linked to oysters.
- One case was linked to recreational product harvested in Washington. The product was raw oyster shellstock.



Area V.p. > 1000 CFU*/gr	Level (CFU/gr)	Date
South Hood Canal	1,200	8/10/2003
North Hood Canal (Quilcene)	1,500	7/14/2003
North Hood Canal (Quilcene)	2,400	7/21/2003

1,490

2,900

1,100

Figure 8. 2003 <u>Vibrio Parahaemolyticus</u> Levels

North Hood Canal (Quilcene)

Hammersley Inlet

Hammersley Inlet

Figure 9. 2003 <u>Vibrio Parahaemolyticus</u> Illnesses

	Commercial WA Oysters	Recreational WA Oysters	Unknown Source or Product
Number of Confirmed Cases	3	1	3
Number III by Harvest Site	1 - Dabob Bay 1 - Skookum Inlet 1 - Hood Canal #5	1 - Seabeck	Unknown
Harvest Dates	7/28/03 - 8/12/03	7/20/03	Unknown
How Consumed	 1 - half shell raw 1 - shellstock raw 1 - barbequed 	1 - shellstock raw	1 - shellstock raw 1 - seafood cocktail raw 1 - unknown

• Three cases were linked to products from an unknown source.

There were no confirmed cases of vibriosis linked to out-of-state product.

Figure 9 provides a breakout of the illness information relating to each category for 2003. For more information contact Richard Lillie at (360) 236-3313.

MARINE BIOTOXIN MONITORING PROGRAM

8/04/2003

6/18/2003

7/29/2003

PSP

The state of Washington routinely experiences seasonal restrictions on commercial and recreational shellfish harvest due to paralytic shellfish poisoning (PSP), more commonly known as "red tide." The biotoxin that causes PSP temporarily interferes



^{*} colony forming units

with the transmission of nerve impulses in warm-blooded animals. The primary symptoms of PSP in humans are numbness and tingling of the lips, tongue, face and extremities, difficulty talking, breathing, swallowing, and loss of muscle coordination. Symptoms develop quickly, usually within 1-2 hours of consumption (very high levels of toxin can produce symptoms within 30 minutes), and typically disappear within 12-24 hours. There is no known antidote for the toxin. Treatment is basically supportive, i.e., artificial respiration, in life threatening cases.

PSP toxin is produced by microscopic organisms that naturally exist in marine water. The species that causes PSP in Washington marine waters is *Alexandrium catenella*. *Alexandrium* is usually present in small numbers; however, when environmental conditions are optimum, rapid reproduction occurs. Filter-feeding shellfish, which include



clams, oysters, mussels, and scallops, can accumulate the toxin to dangerous levels during these "blooms."

DOH monitors PSP toxin levels in shellfish from areas throughout the state. Commercial operations submit PSP samples as a condition for commercial certification. Recreational beaches are sampled as a cooperative effort between DOH, other state agencies, tribes and health departments, often utilizing citizen volunteers. Areas are closed for harvest of molluscan shellfish when PSP toxin levels equal or exceed the Food and Drug Administration standard of 80 micrograms (µg) toxin/100

grams shellfish tissue. Areas are not reopened until testing has confirmed that the PSP toxin has declined to a safe level. Butter clams (*Saxidomus giganteus*) may experience extended closures because they typically retain the PSP toxin longer than other shellfish. An annual regulatory closure for all species is in effect for the Strait of Juan de Fuca, west of Dungeness Spit and the Ocean Beaches from April through October. A recreational razor clam season may be held each spring and fall depending on biotoxin levels and availability of resource.

The DOH Shellfish Office maintains a toll free 24-hour "PSP Hotline" (1-800-562-5632) and a web site (ww4.doh.wa.gov/gis/biotoxin.htm) identifying recreational beach closures. Local health jurisdictions also issue notices through local newspapers and radio. Beach posting is irregular depending on jurisdiction, beach ownership, susceptibility to vandalism and theft, and is not a reliable method of notification.

2003 PSP Summary

The Washington State Public Health
Laboratory analyzed over 3,500 PSP samples
in 2003. The commercial shellfish growers
monitored commercial growing areas biweekly
during 2003. Selected recreational beaches
were monitored biweekly from April through
October by local health jurisdictions, Clallam
County Marine Resource Council, Puget Sound
Restoration Fund, and other volunteers.
Sentinel mussel cage sites were monitored
year-round. There were a total of 14
commercial geoduck closures in 2003.



First Quarter 2003

PSP toxin levels followed the typical pattern for the first quarter of the year, with downward trends throughout the state, prompting the lifting of area closures. In Puget Sound, general closures were lifted in Jefferson, King, Kitsap, Mason, Pierce, and Skagit Counties. There were six geoduck tract closures in the first quarter of 2003.

Second Quarter 2003

PSP toxin continued a downward trend from April through June, with many area closures being lifted or reduced from all species closures to butter clam only closures. The only location in the state that experienced new PSP bloom activity was Drayton Harbor in North Puget Sound. Washington State commonly enters the PSP season with blooms in this area of Whatcom County. However, the bloom, which began in the third week of May, was short in duration and Drayton Harbor was reopened three weeks later. At the end of the second quarter of 2003, new PSP activity was still absent in most parts of Washington, following the example of 2002. There was only one geoduck closure in the second quarter.

Third Quarter 2003

In mid-July, PSP activity began to pick up with



a closure of Quartermaster
Harbor on Vashon Island in
King County. The
following week, Dyes Inlet
in Kitsap County and
Discovery Bay in Jefferson

County closed. In the last week of July, butter clam only closures occurred for the Strait of Juan de Fuca from Dungeness Spit east to Diamond Point in Clallam County, and from Three Tree Point south to the Pierce County line in King County. August saw closures in Clallam County from Cape Flattery east to Low Point at Lyre River and Sequim Bay, and in Kitsap County from Point No Point to Jefferson Head. The closure for Dyes Inlet was lifted at the end of August. The first two weeks of September saw a spectacular PSP bloom close the Port Gamble to Port Ludlow area in Jefferson and Kitsap Counties. Mussels at Port Ludlow reached 1,000 micrograms and geoduck clams at Port Gamble hit a new record for PSP toxin in geoducks at 3,414 micrograms. This closed two Port Gamble area tracts and initiated a commercial geoduck recall, going back two weeks. In all, 36,492 pounds of geoduck clams were recalled. The bloom extended from Oak Bay south into Hood Canal, which was closed from Foulweather Bluff to the Hood Canal Bridge in Kitsap County and to Brown Point in Jefferson County. Mats Mats Bay was also closed. By the end of September, the closure in King County from Three Trees Point south to the Pierce County line, the butter clam only closure in Bellingham Bay in Whatcom County, and the Point No Point south to Jefferson Head closure in Kitsap County were lifted. The all species closure for Quartermaster Harbor on Vashon Island in King County was reduced to a butter clam only closure as well. The rest of the state continued to remain quiet through the third quarter. There were seven geoduck tract closures in the third quarter of 2003.



Fourth Quarter 2003

The fourth quarter of 2003 was unusually quiet. The only commercial PSP closure for the quarter occurred in Dyes Inlet, which closed for the second time in 2003. This closure occurred in the third week in October. However, the closure was a brief one, only lasting till the second week in November. For the first time since 1995, there were no geoduck PSP closures in the fourth quarter of the year. By the second week in October, Port Townsend, Oak Bay, Mats Mats Bay, Port Ludlow, and North Hood Canal south to Pt. Brown were reopened to harvest of all species of shellfish. Kilisut Harbor, including Mystery Bay, was changed from an all species closure to a butter clam only closure. At the end of October, the all species closure in Clallam County for the Strait of Juan de Fuca, from Dungeness Spit westward to Cape Flattery, was lifted. At the same time, the all species closure for Port Gamble in Kitsap County was upgraded to a butter clam and geoduck only closure. By mid-November, the all species closure for Dyes Inlet in Kitsap County was elevated to a butter clam only

closure. By the last week in November, the all species closure for the south part of Sequim Bay and all of Discovery Bay was upgraded to a butter clam only closure. By the middle of December, the all species closure for Samish Bay was lifted.

Sentinel Mussel Monitoring Program

The Department of Health continued the Sentinel Mussel Monitoring Program as an early warning system for marine biotoxins in 2003. With assistance from local health jurisdictions, Tribes, Puget Sound Restoration Fund, and other volunteers, 64 collection sites were maintained and monitored biweekly to monthly. See the map on page 28 (Figure 11) for collection site locations used in 2003.

In addition to the sentinel mussel locations, commercial mussels were routinely monitored at Westcott Bay in San Juan Island, and at Penn Cove and Holmes Harbor in Whidbey Island.

Date	Harvest Area	Species	Toxin Level*
9/11/03	Port Gamble Tract #30100	Geoduck Clam	3,414µg
9/15/03	Sequim Bay State Park	Blue Mussel	2,604µg
9/10/03	Port Gamble Tract #20000	Geoduck Clam	1,946µg
5/15/03	Middle Ground, Sequim Bay	Butter Clam	1,851µg
8/27/03	Discovery Bay Condos	Blue Mussel	1,721µg
9/08/03	Port Ludlow Marina	Blue Mussel	1,000µg

Figure 10. Areas of Highest PSP Levels in 2003

^{*} Micrograms per 100 grams tissue





Figure 11. 2003 Sentinel Biotoxin Mussel Sites



Domoic Acid

Domoic acid is a naturally occurring toxin produced by species of microscopic marine diatoms of the genus *Pseudonitzschia*. The human illness known as amnesic shellfish poisoning (ASP) or domoic acid poisoning (DAP) is caused by eating fish, shellfish, or crab containing the toxin. Symptoms include vomiting, nausea, diarrhea and abdominal cramps within 24 hours of ingestion. In more severe cases, neurological symptoms develop within 48 hours and include headache, dizziness, confusion, disorientation, loss of short-term memory, motor weakness, seizures, profuse respiratory secretions, cardiac arrhythmias, coma, and possibly death. There is no antidote for domoic acid poisoning.

ASP was first characterized in 1987 on the Atlantic Coast of Canada. Domoic acid was first detected on the Pacific Coast in California in the summer of 1991, when a number of pelican and cormorant deaths were linked to domoic acid in anchovies. In the fall of 1991, domoic acid was detected in razor clams off the Washington Coast. This discovery brought a premature end to the recreational razor clam harvest but not before several mild cases of ASP were associated with the consumption of razor clams.

Domoic acid levels are measured using a laboratory technique called high performance liquid chromatography (HPLC). The level of domoic acid determined to be unsafe for human consumption is 20 parts per million (ppm) in molluscan shellfish and 30 ppm for Dungeness crab viscera. The Dungeness

crab areas are closed when three of six individual crab viscera equals or exceeds 30 ppm.

Research shows that razor clams accumulate domoic acid in the edible tissue (foot, siphon, and mantle) and are slow to rid themselves of the toxin. In Dungeness crab domoic acid primarily accumulates in the viscera.

In 1991 DOH began monitoring all major shellfish growing areas for domoic acid. Since 1991, unsafe levels of domoic acid principally have been detected in coastal razor clams and Dungeness crab. However, there have been two exceptions to this pattern. The first was in September 1998, when a California mussel sample from Clallam County's Second Beach, an outside coastal beach, tested 34 ppm. The second exception occurred in September 2003, when a blue mussel from Fort Flagler State Park tested at 29 ppm.

2003 Domoic Acid Summary

Approximately 362 crab and 1196 molluscan shellfish samples were tested for domoic acid in 2003.

First Ouarter 2003

The domoic acid levels in razor clams for the first quarter of 2003 continued downward, following the trend from December 2002. However, levels were still above the closure level of 20 ppm, keeping the recreational razor clam season closed on the coast. The only bright spot was two of the three razor clam samples collected on March 31, 2003



from Long Beach tested 19 ppm. The third sample in the Long Beach set had a test result of 21 ppm, high enough to keep Long Beach closed. Plankton monitoring revealed almost no *Pseudo-nitzschia* cells present in the water.

Elevated domoic acid results in Dungeness crab prompted the department to increase sampling to weekly. On February 7, 2003, DOH closed all crab harvesting in Willapa Bay, where crab samples reached levels as high as 60 ppm. On February 21, after more sampling in Willapa Bay, the department reopened the southern half of Willapa Bay to crab harvesting.

Second Quarter 2003

The domoic acid levels in razor clams remained high for the second quarter of 2003. Plankton monitoring revealed a slight rise in *Pseudo-nitzschia* cells in the water in April. This was followed by a rise in the domoic acid levels in the razor clams. Razor clam samples at Long Beach went from toxin levels in the teens to the mid-thirties, dashing all hopes of a spring sport clam season.

Monitoring Dungeness crab from the outside coast for domoic acid continued on a weekly basis due to elevated toxin levels. On April 25, 2003, the Dungeness crab closure for the north half of Willapa Bay that began on February 7, 2003, was lifted. Despite an



occasional high individual crab test result, the crab samples for the outside coast continued to meet the criteria for the coast to remain open for crab harvesting.

Third Quarter 2003

The third quarter of 2003 began with coastal razor clam toxin levels on the decline. However, in August the toxin levels showed a modest gain, which was quickly followed by a downward trend to the delight of the recreational razor clam harvesters. Long Beach, Twin Harbors, Copalis, and Kalaloch reached safe toxin levels and were opened for three harvest days in September. This was a departure from the traditional October fall opening. Mocrocks continued to exceed the standard and remained closed. The Department of Fish and Wildlife reported sport harvesters on the beaches in record numbers, estimating 64,000 "digger trips" to the four ocean beaches for the three days of clam harvesting. An estimated 648,000 clams were harvested.

The commercial razor clam season for the Willapa Spits could not open in May, the traditional opening time, because clam toxin levels were reported as high as 88 ppm. The commercial harvest finally began on August 9, 2003, only to close again on August 11, 2003. On August 25, 2003, the season reopened and continued until September 14, 2003.

On September 11, 2003, a historic domoic acid bloom was detected in the inland waters of Puget Sound. A blue mussel sample collected on September 2, 2003, from Fort Flagler State Park, located on Marrowstone Island in



Jefferson County, had a domoic acid test result of 29 ppm. This is the first time a Puget Sound sample tested over the closure limit of 20 ppm. The bloom extended over a wide area of Central Puget Sound and the Strait of Juan de Fuca, as domoic acid levels were detected from Port Angeles to west Whidbey Island and as far south as Port Ludlow. However, none of the other samples tested over 20 ppm.

Fourth Quarter 2003

The downward trend in toxicity in razor clams observed in the third quarter continued in the fourth quarter of 2003. The one exception was Kalaloch, which continued to test just over 20 ppm for October and November. Long Beach, Mocrocks, and Twin Harbors were opened for three days of recreational razor clam harvest in October. Copalis was not opened because the tremendous turnout during the three day harvest in September harvested 95% of the annual allowable harvest of clams for that beach. There were no razor clam harvest days on any of the recreational coastal beaches in November. In December, Long Beach, Twin Harbors, and Kalaloch each had three days of harvest, while Mocrocks was only open for two days.

Domoic acid test results for Dungeness crab reflected the low toxicity of the razor clams. Most crab samples were NTD (no toxin detected). The highest test result was only 6 ppm at the mouth of Willapa Bay. This allowed testing to revert back to the monthly schedule. The highest domoic acid levels for the year are listed in Figure 12.

For more information on PSP and Domoic Acid contact Frank Cox at (360) 236-3309.

Summary of PSP Status for PSAMP

Each year DOH analyzes spatial and temporal trends in PSP for the Puget Sound Ambient Monitoring Program (PSAMP). This year, DOH examined results from 31 of its sentinel monitoring sites for Paralytic Shellfish Poisoning (PSP) toxin in Puget Sound and the straits of Georgia and Juan de Fuca. PSP toxin was measured in mussels collected at each sentinel site.

Figure 13 shows PSP results sorted into PSP impact categories (as defined in the legend) for calendar year 2003 from each sentinel site. A pie chart summarizes the fraction of results in each category at each site. Eight of 31 sentinel sites had at least minimum PSP impact, compared to 17 sites reported in last year's Annual Inventory.

Figure 14 compares PSP impact at sentinel sites from 2001 through 2003. An "Impact Factor" developed by DOH was used to compare sentinel sites for differences among years. The PSP Impact Factor ranges from 1.0 (no impact) to 3.0 (maximum Impact). Sixteen sites were lower in 2003 than in 2002. Three were higher: Sequim and Discovery Bays (Strait of Juan de Fuca) and Port Ludlow (Admiralty Inlet). The remaining 12 sites remained unchanged with no PSP impact. Six of 10



BLUE

sentinel sites in the Main Basin were lower and four were unchanged. In South Puget Sound, four of six sites showed reduced PSP impact in 2003 and four were unchanged. Hood Canal south of Lofall remained clear of PSP impact. South Puget Sound was clear of PSP impact for the first time since 2000.

PSP data were pooled for all 31 sampling sites and a Puget Sound-wide PSP impact factor was calculated for each year. The PSP impact Factor for 2001 was 1.10. The PSP impact in 2002 was the highest of the three years (1.14). The lowest PSP impact occurred in 2003 (Impact Factor = 1.04).

RECREATIONAL SHELLFISH **PROGRAM**

The goal of the Recreational Shellfish Program is to protect the health of recreational harvesters by providing them with sufficient information to make informed decisions about where and when it is safe to harvest shellfish.

Consolidated Contracts

Local health jurisdictions play an important role in protecting the health of recreational shellfish harvesters. All 12 Puget Sound counties received funding through their consolidated contract with DOH for recreational shellfish activities.

	Date	Harvest Area	Species	Toxin Le	
	02/13/03	Mocrocks Area BC	Razor Clam	108	
	01/28/03	Kalaloch Beach	Razor Clam	103	
- 1					

Figure 12. Areas of Highest Domoic Acid Levels in 2003

Date	Harvest Area	Species	Toxin Levei*
02/13/03	Mocrocks Area BC	Razor Clam	108
01/28/03	Kalaloch Beach	Razor Clam	103
01/28/03	Copalis QBR	Razor Clam	99
05/08/03	Willapa Spits	Razor Clam	88
01/21/03	Long Beach Reserve	Razor Clam	72
02/27/03	Twin Harbors Area CL	Razor Clam	69
02/11/03	Cape Disappointment to Pt. Brown	Dungeness Crab	60
03/27/03	North Willapa Bay	Dungeness crab	59
05/17/03	Quinault Reservation Area B	Razor Clam	55
01/13/03	Pt. Brown to Queets River	Dungeness Crab	51
04/15/03	Queets River to Toleak Pt.	Dungeness Crab	33
09/02/03	Fort Flagler State Park (Marrowstone Island)	Blue Mussel	29

^{*} parts per million



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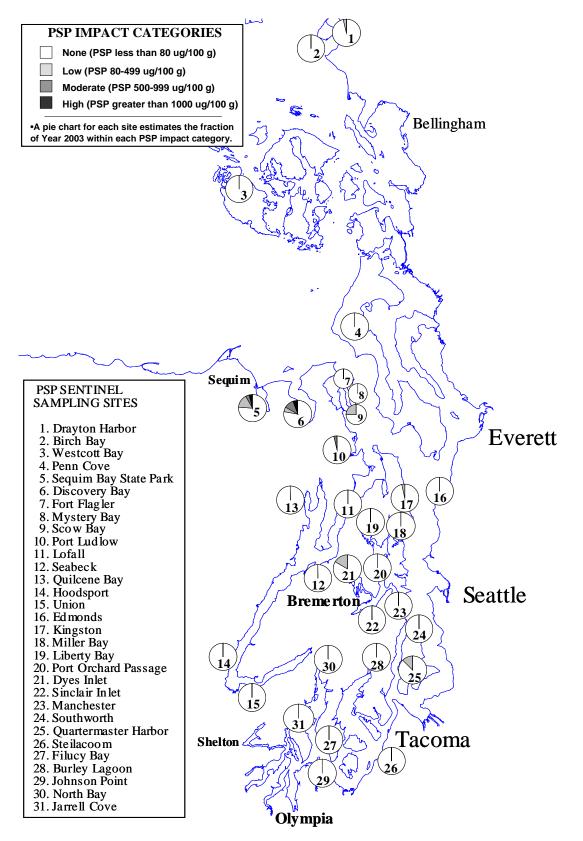


Figure 13. 2003 PSP Sentinel Sites Results



Local participation in biotoxin sampling is a key component of the contracts. Over 30% of Puget Sound biotoxin samples were collected by local health jurisdictions in 2003.

Local health agencies implemented a number of recreational shellfish education and outreach programs through consolidated contracts in 2003. This preventive approach to recreational harvester health promotion is a valuable aspect of the consolidated contracts/ local health partnership. Projects in 2003 included participation in community events and fairs, partnerships with local schools and state parks, educational talks, outreach to high risk harvester populations, newsletter production, and local shellfish telephone hotlines.

High Risk Harvest

High risk harvesters are those harvesting populations who do not understand or have

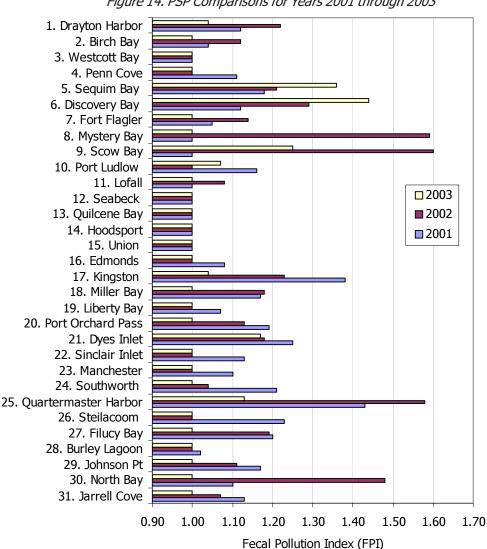


Figure 14. PSP Comparisons for Years 2001 through 2003



access to health information to assure that the shellfish they harvest are safe to eat. To assess high risk harvest, DOH compares recreational harvester counts calculated by the Department of Fish and Wildlife with pollution data to identify high-risk beaches. Education and outreach efforts are then targeted at those areas to inform the public.

Many of the Asian and Pacific Island (API) communities have long been identified as high risk harvesters due to cultural and language barriers. Focus remains on communicating health risks for recreational harvesters in these communities and assisting with interpretation of health warning and regulatory information.

Beach Classifications

Recreational shellfish beaches are classified by DOH as Approved, Advisory, Closed, and Unclassified. Further analysis of the harvest on Unclassified beaches will help guide classification and education efforts in 2004.

Approved

Approved beaches meet the sanitary standards of water quality and shoreline conditions for shellfish harvest.

<u>Advisory</u>

The Advisory classification is given to those beaches with special circumstances that impact public health, such as a partially closed beach, rainfall closure, seasonal marina, a "Cook All Shellfish" designation, etc. For more information regarding the status of an Advisory Beach please call your local health jurisdiction or DOH at (360) 236-3330.

Closed

Closed beaches are those that either reside within a Prohibited or Restricted commercial area, or otherwise do not meet sanitary standards for water quality and shoreline conditions for shellfish harvesting.

Other reasons that a beach may be closed include the presence of *Vibrio* parahaemolyticus, sewage treatment plant outfalls, and emergency situations. DOH supplies signs explaining situations that may affect public health. Figure 15 shows the recreational harvest signs provided by DOH.

Web Site Improvements

In 2002 a new web site was launched that provides information on recreational beach closures. This site works with a mapping tool and shows recreational beach areas that are closed from biotoxins, pollution events, or other health risks. The mapping site's

address is www.doh.wa.gov/biotoxinmaps.htm.

For more information on the Recreational Shellfish Program contact Kim Zabel-Lincoln at (360) 236-3310.



CLAM



Figure 15. Current Recreational Shellfish Harvest Signs











